UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

SINGULAR COMPUTING LLC, Plaintiff, v. GOOGLE LLC, Defendant.	Civil Action No. 1:19-cv-12551-FDS

PLAINTIFF'S OPPOSITION TO DEFENDANT'S RULE 12(b)(6)
MOTION TO DISMISS FOR LACK OF PATENTABLE SUBJECT MATTER

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Plaintiff, Singular Computing, LLC ("Singular"), respectfully submits this brief in opposition to the motion of defendant, Google LLC ("Google"), to dismiss this case pursuant to Fed. R. Civ. P. 12(b)(6) for lack of patentable subject matter ("Mot." or "Motion"). For the reasons set forth below, the Motion should be denied.

I. BACKGROUND

A. THE INVENTOR AND THE PATENTS-IN-SUIT

The patents-in-suit do not claim a mere "abstract idea". To the contrary, the claims define a computer having a specific new architecture that causes the computer to run up to thirty times more efficiently than the prior art computers. *See* Amended Complaint ("AC"), Dkt. No. 37 at ¶ 14. The sole inventor, Dr. Joseph Bates, built such a computer and, in response to Google's repeated requests, he demonstrated it to Google's engineers at Google's campus. *Id.* at ¶¶ 14, 17-19. Thereafter, Google copied Dr. Bates' architecture on a massive scale. *Id.* at ¶¶ 22-25.

Dr. Bates is no run-of-the-mill inventor. At the age of 13, he was admitted to the computer science undergraduate program at Johns Hopkins University. *Id.* at ¶ 7. By age 17, Dr. Bates had earned his bachelor's and master's degrees in computer science from Johns Hopkins. *Id.* By age 23, he had earned his doctoral degree in computer science from Cornell University. *Id.*

After college, Dr. Bates' research centered around several cutting-edge areas of computer science, including computing systems for seeing, hearing and understanding -- technologies that today fall under the rubric of artificial intelligence ("AI"). *Id.* at ¶ 14. By 2009, even though a standard desktop computer contained over a billion transistors, it typically performed only a few hundred operations per clock cycle. *Id.* at ¶ 8. Dr. Bates set about to improve this performance. He conceived and built a new computer based on new, highly unconventional computer

architecture. *Id.* at ¶¶ 42, 43. He called his new computer a "Low Precision High Dynamic Range" or "LPHDR" computer. *Id.* at ¶ 42. The original provisional application for the patents-in-suit was filed on June 19, 2009. *See* Ex. A, front page.[1] All of the asserted claims are apparatus claims directed to his new LPHDR computer.

B. DR. BATES DISCLOSED HIS LPHDR COMPUTER TO GOOGLE

As Dr. Bates was building a prototype of his LPHDR computer, Google was having problems with its computer systems that provided AI-based services such as Google Translate, Photo, Search and Assistant. *Id.* at ¶ 15. Google's AI services required far more computing power than could be provided by Google's then-existing high precision computers. *Id.* at ¶ 23. Google realized that, absent finding a solution to this problem, it would have to at least double the capacity of all of its data centers throughout the United States at a cost of at least $10 billion dollars. *Id.* at ¶ 24. In Google's own words, its lack of computing power was "scary and daunting". *Id.* at ¶ 15.

By early 2017, at Google's request, Dr. Bates had met with Google on at least three separate occasions under an NDA prepared by Google. *Id.* at ¶¶ 17-18. At Google's request, Dr. Bates disclosed and demonstrated his LPHDR architecture to Google at its campuses in California. *Id.* at ¶¶ 17-22. Dr. Bates advised Google that the demonstrated prototype and architecture were patent protected. *Id.* at ¶¶ 18-19. After having gained access to Dr. Bates' LPHDR computer, and following failed acquisition discussions, Google abandoned its high precision-based computer architecture for its AI-based services.

[1] Copies of the three patents-in-suit are attached as Exhibits A-C to the accompanying Declaration of Kevin Gannon.

In its place, Google copied Dr. Bates' patented architecture and installed the accused LPHDR computers, known as Google Cloud Tensor Processing Units version 2 ("TPUv2") and version 3 ("TPUv3"), in Google's data centers throughout the United States. *Id.* at ¶¶ 22-26. Using Dr. Bates' LPHDR patented architecture, Google was able to provide its AI-based services, such as Ads, Translate, Photo, Search and Assistant, without having to build new data centers. *Id.* at ¶¶ 24-25. On information and belief, Google is currently using infringing LPHDR computers (TPUv2 and TPUv3) at all of its 11 data centers throughout the United States. *Id.* at ¶ 26.

C. STATUS OF THE CASE

Singular filed the Complaint herein on December 20, 2019 and the AC on March 20, 2020. Three patents are asserted: the '273 patent, the '156 patent, and the '961 patent. Google has not answered. There has been no claim construction and no discovery has been taken to date. In similar circumstances, this Court denied a pre-claim construction 101 motion. *See Sandborn P'ship. v. Avid Tech., Inc.*, No. 11-11472-FDS, 2013 WL 4784265 (D. Mass. Sept. 5, 2013). Similarly, Judge Albright in the Western District of Texas recently declined to entertain a 101 motion prior to claim construction and discovery. *See Slyce Acquis. Inc. v. Syte - Visual Conception Ltd.*, No. W-19-cv-00257-ADA, 2020 WL 278481, at **4-5 (W.D. Tex. Jan. 10, 2020).

II. THE REPRESENTATIVE CLAIMS

The representative claims are claim 53 of the '273 patent, claim 7 of the '156 patent and claim 4 of the '961 patent. *See*, AC at ¶¶ 31, 47, 64. Each is asserted against Google in this case. *Id.* Contrary to Google's argument (Mot. at 7-8), the representative claim is not solely claim 53 (the only claim substantively addressed in Google's brief). Claims 53, 7, and 4 have different

elements and different scopes. *See e.g.*, *Tandon Corp. v. U.S. Intern. Trade Com'n*, 831 F.2d 1013, 1023 (Fed. Cir. 1987)(claims of different patents are presumed to have different scopes).

III. LEGAL STANDARDS

Regional Circuit law applies to motions to dismiss under Rule 12(b)(6). *See*, *e.g.*, *Endo Pharms. Inc. v. Tea Pharms. USA, Inc.*, 919 F.3d 1347, 1352 (Fed. Cir. 2019). On a motion to dismiss, the Court "must assume the truth of all well-plead[ed] facts and give plaintiff the benefit of all reasonable inferences therefrom." *Ruiz v. Bally Total Fitness Holding Corp.*, 496 F.3d 1, 5 (1st Cir. 2007) (citing *Rogan v. Menino*, 175 F.3d 75, 77 (1st Cir. 1999)); *see also Sandborn P'ship. v. Avid*, No. 11-11472-FDS, Dkt. No. 55, at 3.

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." 35 U.S.C. § 101. Issued patents are presumed valid because "the Patent and Trademark Office has already examined whether the patent satisfies 'the prerequisites for issuance of a patent,' including § 101." *Cellspin Soft, Inc. v. Fitbit, Inc.*, 927 F.3d 1396, 1319 (Fed. Cir. 2019) (quoting *Microsoft Corp. v. i4i Ltd. P'ship*, 564 U.S. 91, 100 (2011)). Thus, a challenge to the validity of a patent under § 101 must be proved by clear and convincing evidence. *Cellspin*, 927 F.3d at 1319 (citing *Berkheimer v. HP Inc.*,, 881 F.3d 1360, 1368 (Fed. Cir. 2018)).

Patent protection does not extend to laws of nature, natural phenomena or abstract ideas. *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 573 U.S. 208, 216-17, 134 S. Ct. 2347, 2354 (2014). In determining eligibility, courts must "distinguish between claims to patent ineligible subject matter and those that 'integrate the building blocks into something more.'" *Natural Alternatives*

Int'l, Inc. v. Creative Compounds LLC, 918 F.3d 1338, 1342 (Fed. Cir. 2019) (quoting *Alice*, 573 U.S. at 217).

The first step is to determine whether the claims are "directed to" a patent ineligible concept. *Alice*, 573 U.S. at 217. In this analysis, courts must be careful as "too broad an interpretation of this exclusionary principle could eviscerate patent law. For all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas." *Natural Alternatives*, 918 F.3d at 1342 (quoting *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 71 (2012)). If the claims are not directed to a patent-ineligible concept under Step 1, the court need not address Step 2. *Endo Pharms.*, 919 F.3d at 1352. The second step, if the claim is found to be directed to ineligible subject matter, is to determine "whether the additional elements 'transform the nature of the claim' into a patent eligible application," *i.e.* whether there is an inventive concept. *Alice*, 573 U.S. at 217 (quotation marks and citation omitted).

Eligibility under 35 U.S.C. § 101 is a question of law based on underlying facts. *Natural Alternatives*, 918 F.3d at 1342. It may be resolved on a motion to dismiss only when there are no factual allegations that, taken as true, prevent resolving the eligibility question as a matter of law." *Id.* (quoting *Aatrix Software, Inc. v. Green Shades Software, Inc.*, 882 F.3d 1121, 1125 (Fed. Cir. 2018)). When the complaint "ma[kes] specific, plausible factual allegations about why aspects of [the] claimed inventions were not conventional, . . . [t]he district court err[s] by not accepting those allegations as true." *Cellspin*, 927 F.3d at 1317-18 (quoting *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1336 (Fed. Cir 2016)). Thus, "an inventive concept can be found in the non-conventional and non-generic arrangement of known, conventional pieces."

BASCOM Global Internet Servs., Inc. v. AT&T Mobility LLC, 827 F.3d 1341, 1350 (Fed. Cir. 2016).

"[W]hether a claim element or combination of elements is well-understood, routine and conventional to a skilled artisan in the relevant field is a question of fact . . . [and] must be proven by clear and convincing evidence." *Berkheimer v. HP*, 881 F.3d at 1368 (citing *Microsoft v. i4i*, 564 U.S. at 95). "Claims directed to 'an improvement to computer functionality itself, not on economic or other tasks for which the computer is used in its ordinary capacity,' are patent eligible." *Cellspin*, 927 F.3d at 1315 (quoting *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1336 (Fed. Cir 2016)). Thus, "patentees who adequately allege their claims contain inventive concepts survive a § 101 eligibility analysis under Rule 12(b)(6)." *Aatrix*, 882 F.3d at 1126-27.

IV. ARGUMENT

A. GOOGLE'S MOTION IS PREMATURE AND SHOULD BE SUMMARILY DENIED

Google's motion should be denied out-of-hand for several reasons:

1. The Federal Circuit has made clear that a claimed invention directed to an improvement to computer functionality is patent eligible. *See, e.g., Enfish*, 822 F.3d at 1336; *see also SRI Int'l, Inc. v. Cisco Sys., Inc.*, 930 F.3d 1295, 1303-04 (Fed. Cir. 2019). As alleged in the AC, the patents-in-suit are directed to improvements in computer functionality. *See* AC at ¶¶ 46, 63, 77. Accordingly, in an effort to avoid the controlling law, Google repeatedly argues that the claimed subject matter is: (a) entirely conventional; and (b) not an improvement to computing technology:

- **The claims "offer no improvement to computing technology."** (Mot. at 2).
- **"The patent specification refers to then-existing, conventional computing implementations"** (*Id.* at 5).

- **"the patented inventions are "entirely conventional"** (*Id.* at 5-6).

As stated by the Federal Circuit, "whether something is well-understood, routine, and conventional to a skilled artisan at the time of the patent is a factual determination." *Berkheimer v. HP*, 881 F.3d at 1369. Whether something is "an improvement" is likewise a question of fact. *Id.* Google's assertions are directly disputed by Singular which alleges that the claimed invention: (a) is not conventional; and (b) is an improvement to computer technology. For example, regarding the '273 patent, the AC alleges as follows:

> 14. After filing this seminal patent application, Singular under the direction of Dr. Bates built a computer incorporating its novel architecture. The Singular prototype was able to execute a software program that performed conventional neural network image classification, for example, at a rate 30 times faster than a conventional computer having comparable physical characteristics in terms of its number of transistors, its semiconductor fabrication process and power draw.
>
> 43. The device (computer) of claim 53 was not conventional. Reducing the invention to practice required the design and manufacture of hardware different from the hardware used in conventional processing units, because conventional hardware at that time was completely unsuitable to implement the invention.
>
> 46. The claimed advance to which claim 53 was directed was a computer that can execute a far larger number of operations per period than a conventional computer, while supporting software programs that require operations to be performed on numbers having high dynamic range, by:
>
> a. adding to a computer at least 100 LPHDR units, each LPHDR unit manipulating numbers having a range of at least 1,000,000 to 1/1,000,000, and each LPHDR unit's operations being imprecise by at least 0.05% for at least 5% of its possible inputs;
>
> b. combining with that number of LPHDR units, a far smaller number of execution units that each execute the operation of multiplication on floating point values that are at least 32 bits wide, that far smaller number being at least 100 fewer than the number of LPHDR units in the computer.

See also AC at ¶¶ 16-33, 42-43, 46, 82-85; '273 patent (Ex. A) at 20:31-39. Similar allegations are made in the AC regarding the '156 patent (*id.* at ¶¶ 100-102) and the '961 patent (*id.* at ¶¶ 118-120). As the Federal Circuit stated in *Aatrix*, "[i]n light of the allegations made by

Aatrix, the district court could not conclude at the Rule 12(b)(6) stage that the claimed elements were well-understood, routine, or conventional." *Aatrix*, 882 F.3d at 1129.

As Singular's allegations are to be taken as true at this time (*id.* at 1130), the Court should accept Singular's assertions that the claimed invention is not conventional and is an improvement to computer technology. *Id.*[2] Accordingly, on this record alone, the claims at issue are patent eligible. *See Cellspin*, 927 F.3d at 1316-18; *Aatrix*, 882 F.3d at 1128; *see also Kenexa Brassring, Inc. v. HireAbility, LLC*, No. 12-10943-FDS, 2015 WL 1943826, at *7 (D. Mass. Apr. 28, 2015).

2. As this Court stated previously, "[t]he question of what limitations are, or are not, included in the claim terms is, among other things, inherently tied up with the process of claim construction." *Sandborn P'ship. v. Avid*, 2013 WL 4784265, at *6. Google states that high dynamic range "is, literally, just mathematics, and it is completely abstract." Mot. at 10. Google also states low precision means "the execution unit is not adapted to calculate the precise correct mathematical result every time…" *Id.* at 11. High dynamic range, however, is defined in the claims using very precise limitations. *See, e.g.*, '273 patent at 32:60-63. Similarly, low precision is defined in the claim. *Id.* at 32:3-12. Singular certainly does not agree with Google's unilateral claim construction which is inconsistent with the expressed language of the claims at issue. Google's motion for judgment on the pleadings should be denied because, as in *Aatrix*, 882 F.3d at 1129 and *Sandborn*, Dkt. 2013 WL 4784265, at *6, issues of claim construction preclude granting a motion to dismiss.[3]

[2] Google argues that Singular's allegations of improvement and non-conventionality are conclusory. *See* Mot. at 15-17. As the quoted paragraphs set forth and cited above demonstrate, Singular's allegations are highly detailed and specific, not conclusory.

[3] Google has not offered to stipulate that in this case the asserted claim terms need no construction or that the claims should be given their ordinary meaning. Instead, Google

3. Google asks the Court to take judicial notice of the 1985 IEEE 754 standard, erroneously stating that the 1985 standard is "expressly referenced in the specification." *See* Mot. at 4. Moreover, Google attempts to use this publication as prior art which is inappropriate at this stage of the proceedings. "The issues of novelty and obviousness do not bear on the question of subject matter eligibility." *See Kenexa*, 2015 WL 1943826, at *3 (citing *Diamond v. Diehr*, 450 U.S. 175, 188-89 (1981)). Google also attempts to rely upon *Heron's Mathematics* (Mot. at 10 n. 8), Henderson's Encyclopedia (*id.* at 15) and an article from https://mitmuseum.mit.edu (*id.* at 15 n. 9).[4] As this Court has previously stated, choosing to consider such extraneous evidence "at this stage . . . would convert the motion [to dismiss] into one for summary judgment." *Kenexa*, 2015 WL 1943826, at *4. As in that case, and given the lack of any discovery, the Court should "not exercise its discretion to convert defendant's motion into one for summary judgment." *Id.*; *see also Slyce v. Syte*, 2020 WL 278481, at **5-6 (declining to address 101 motion to dismiss prior to discovery and claim construction).

B. STEP 1: THE ASSERTED CLAIMS ARE NOT DIRECTED TO ABSTRACT IDEAS

1. Problems with Prior Art Computers

Claim 53 of the '273 patent states as follows:

A device:

comprising at least one first low precision high-dynamic range (LPHDR) execution unit adapted to execute a first operation on a first input signal representing a first numerical value to produce a first output signal representing a second numerical value,

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conveniently reserves its claim construction arguments for a second bite at the apple should the Court deny the present Motion.

[4] In a separate brief filed concurrently herewith, Singular opposes Google's Request to Take Judicial Notice and requests the Court to reject Google's attempt to rely upon the IEEE document (as well as three other references), as none of the documents is referenced in the patent specification or in the AC.

> wherein the dynamic range of the possible valid inputs to the first operation is at least as wide as from 1/1,000,000 through 1,000,000 and for at least X=5% of the possible valid inputs to the first operation, the statistical mean, over repeated execution of the first operation on each specific input from the at least X % of the possible valid inputs to the first operation, of the numerical values represented by the first output signal of the LPHDR unit executing the first operation on that input differs by at least Y=0.05% from the result of an exact mathematical calculation of the first operation on the numerical values of that same input;
>
> wherein the number of LPHDR execution units in the device exceeds by at least one hundred the non-negative integer number of execution units in the device adapted to execute at least the operation of multiplication on floating point numbers that are at least 32 bits wide. *Id.* at 31.

At Step 1 of *Alice*, the Court "must first examine the . . . patent's 'claimed advance' to determine whether the claims are *directed to* an abstract idea." *Finjan, Inc. v. Blue Coat Sys., Inc.*, 879 F.3d 1299, 1303 (Fed. Cir. 2018) (italics added). This entails evaluating "the focus of the claimed advance over the prior art." *Koninklijke KPN N.V. v. Gemalto M2M GmbH*, 942 F.3d 1143, 1149 (Fed. Cir. 2019) (citation omitted). Courts "look to whether the claims focus on a specific means or method." *Secured Mail Solutions LLC v. Univ. Wilde, Inc.*, 873 F.3d 905, 909 (Fed. Cir. 2017); *see also SAP Am., Inc. v. Investpic, LLC*, 898 F.3d 1161, 1167 (Fed. Cir. 2018) (claims not abstract if they "transform a claim from one claiming only a result to one claiming a way of achieving it.")

The patent and AC describe the problems with prior art computers at the time Dr. Bates filed his first patent application. For example, the AC alleges as follows:

> 8. . . . Under then existing computer architectures, even computers containing over a billion transistors were architected so as to typically perform only a handful of operations per unit of time ("period") when using CPUs. Such conventional computers typically performed only a few hundred operations per period when using GPUs.
>
> 42. . . . For example, [prior art] graphics processors that included support for 16-bit floating point, alongside support for 32 bit floating point and 64 bit floating point, as disclosed in the '273 Patent at 5:31-33, did not have any execution units that receive as an input an electrical signal representing numbers having a dynamic range at least as wide as from 1/1,000,000 through 1,000,000, and that transmit as an output for at least X = 5% of the possible valid inputs to that operation, an electrical signal representing numbers that differ by at least 0.05% from the result of an exact mathematical calculation of that operation on the numerical values

> of that same input. The [prior art] graphics processors disclosed in the '273 Patent at 5:31-33 did not include a single LPHDR execution unit according to claim 53.

See also '273 patent at 1:28-2:7; 3:7-4:62. The foregoing describes how prior art computers used massive amounts of transistors, but were only capable of performing a relatively small number of operations.

2. The Solutions Provided by the Patents-in-Suit

A patent claim is not abstract if it "transform[s] a claim from one claiming only a result to one claiming a way of achieving it." *SAP Am. v. Investpic*, 898 F.3d at 1167. As alleged in the AC, the patents-in-suit describe how the features of the claimed invention achieved an improvement in computer-throughput performance. For example, the AC asserts as follows:

> 9. The new, novel and improved computer architectures developed by Dr. Bates, provide for the inclusion within computer processors, of processing elements designed to perform low precision and high dynamic range (LPHDR) arithmetic operations.
>
> 14. After filing this seminal patent application, Singular under the direction of Dr. Bates built a computer incorporating its novel architecture. The Singular prototype was able to execute a software program that performed conventional neural network image classification, for example, at a rate 30 times faster than a conventional computer having comparable physical characteristics in terms of its number of transistors, its semiconductor fabrication process and power draw.
>
> 42. The device of claim 53 substantially differs structurally from devices in the prior art. . . . Dr. Bates was the first to reduce to practice a computer that includes an LPHDR execution unit, and even coined "LPHDR" to describe the unit. As computers that included LPHDR execution units did not exist in the prior art, their use in the invention was not the use of existing computing technology or an existing implementation of computer processors.
>
> 44. The novel architecture of the device of claim 53 yielded the following advantages over prior art computing devices:
>
> a. more efficient use of a computer's transistors, by requiring a far smaller number of transistors per multiplication operation done by the one or more LPHDR units than the execution units of conventional computers;
>
> 46. The claimed advance to which claim 53 was directed was a computer that can execute a far larger number of operations per period than a conventional computer, while supporting software programs that require operations to be performed on numbers having high dynamic range, by:

a. adding to a computer at least 100 LPHDR units, each LPHDR unit manipulating numbers having a range of at least 1,000,000 to 1/1,000,000, and each LPHDR unit's operations being imprecise by at least 0.05% for at least 5% of its possible inputs;

b. combining with that number of LPHDR units, a far smaller number of execution units that each execute the operation of multiplication on floating point values that are at least 32 bits wide, that far smaller number being at least 100 fewer than the number of LPHDR units in the computer.

See also AC at ¶¶ 43-44, 80-85; '273 patent at 5:63-17:27; Figs. 1-6.

63. The advance to which claim 7 was directed was a computer having a heterogeneous architecture that can support a wider range of software programs, can execute a far larger number of operations per period than a conventional computer, while supporting software programs that require operations to be performed on numbers having high dynamic range, by:

a. adding to a computer at least 100 LPHDR units, each LPHDR unit manipulating numbers having a range of at least 1,000,000 to 1/1,000,000, and each LPHDR unit's operations being imprecise by at least 0.05% for at least 5% of its possible inputs;

b. combining with that number of LPHDR units, a far smaller number of execution units that each execute the operation of multiplication on floating point values that are at least 32 bits wide, that far smaller number being at least 100 fewer than the number of LPHDR units in the computer; and

c. further incorporating a computing device that is of a central processing unit (CPU), a graphics processing unit (GPU), a field programmable gate array (FPGA), a microcode-based processor, a hardware sequencer, and a state machine, and that controls the operation of the LPHDR units.

See also AC at ¶¶ 59-62; '156 patent at 6:1-17:29, Figs. 1-6.

77. The claimed advance to which claim 4 was directed was a computer that can execute a far larger number of operations per period than a conventional computer, while supporting software programs that require operations to be performed on numbers having high dynamic range, by:

a. adding to a computer at least one LPHDR unit, each LPHDR unit manipulating numbers having a range of at least 1,000,000 to 1/1,000,000, and each LPHDR unit's operations being imprecise by at least 0.2% for at least 10% of its possible inputs; and,

b. further incorporating another computing device that controls the operation of the one or more LPHDR execution units.

See also AC at ¶¶ 71-76; '961 patent at 5:56-17:39, Figs. 1-6.

Thus, the specification, the claims and the AC describe the claimed improvements in computers themselves and how to achieve such improvements. As set forth above, this is sufficient under *Alice* Step 1. Accordingly, claims 53, 7 and 4 are not directed to an abstract idea. *See, e.g.*, *Enfish*, 822 F.3d at 1337-39; *Koninklijke KPN v. Gemalto*, 942 F.3d at 1150-52.

C. STEP 2: THE ASSERTED CLAIMS RECITE INVENTIVE CONCEPTS

As the asserted claims are not directed to abstract ideas, there is no need for the Court to address Step 2 of the *Alice* test for eligibility. *See, e.g.*, *Endo Pharms.*, 919 F.3d at 1352. Should the Court proceed to Step 2, the task is to determine "whether additional elements 'transform the nature of the claim' into a patent eligible application", *i.e.* whether there is an inventive concept. *Alice*, 573 U.S. at 217 (quotation marks and citation omitted). As the Federal Circuit has explained, a claim passes the Step 2 test when it "may be read to 'improve an existing technological process.'" *BASCOM v. AT&T*, 827 F.3d at 1351 (quoting *Alice*, 134 S. Ct at 2358)).

1. The '273 Patent

As set forth *supra*, the AC provides specific examples of the structural elements of the claimed LPHDR computer and explains why that structure was new, unconventional and an improvement to computer performance:

> 42. The device of claim 53 substantially differs structurally from devices in the prior art. For example, graphics processors that included support for 16-bit floating point, alongside support for 32 bit floating point and 64 bit floating point, as disclosed in the '273 patent at 5:31-33, did not have any execution units that receive as an input an electrical signal representing numbers having a dynamic range at least as wide as from 1/1,000,000 through 1,000,000, and that transmit as an output for at least X = 5% of the possible valid inputs to that operation, an electrical signal representing numbers that differ by at least 0.05% from the result of an exact mathematical calculation of that operation on the numerical values of that same input. The graphics processors disclosed in the '273 patent at 5:31-33 did not include a single LPHDR execution unit according to claim 53. *Dr. Bates was the first to reduce to practice a computer that includes an LPHDR execution unit, and even coined "LPHDR" to describe the unit. As computers that included LPHDR execution units did not exist in the*

prior art, their use in the invention was not the use of existing computing technology or an existing implementation of computer processors.

43. The device (computer) of claim 53 was not conventional. Reducing the invention to practice required the design and manufacture of hardware different from the hardware used in conventional processing units, because conventional hardware at that time was completely unsuitable to implement the invention.

83. *The '273 patent teaches a technological solution to this problem in the form of novel, unconventional and counterintuitive computer architectures that include, inter alia, the following*:

(i) at least one LPHDR execution unit (e.g., a processing element) that:

a. accepts input signals representing numerical values, that each have a dynamic range that is at least as wide as from 1,000,000 to 1/1,000,000, and

b. produces output signals representing numerical values, in response to requested arithmetic operations, that differ by at least 0.05% from their respective exact results for at least 5% of all possible valid such requested operations; and,

(ii) a number of LPHDR execution units that exceeds by at least 100 the number of higher precision (e.g., 32 bit) floating point multiplication processing elements.

See AC, ¶¶ 42-43, 82-83 (italics added); *see also id.* at ¶¶ 44-46, 84-86; '273 patent at 2:11-17:27; Figs. 1-6. These allegations of the AC must be accepted as true in the context of a Rule 12(b)(6) motion. *Ruiz v. Bally*, 496 F.3d at 5.

2. The '156 Patent and the '961 Patent

Likewise, for claim 7 of the '156 patent and claim 4 of '961 patent that Google does not separately address, the AC provides detailed examples of the structural elements of the claimed LPHDR computer and asserts that the structure was new, unconventional and an improvement to computer performance.

59. The device of claim 7 substantially differs structurally from devices in the prior art. For example, graphics processors that included support for 16-bit floating point, alongside support for 32 bit floating point and 64 bit floating point, as disclosed in the '156 patent at 5:36-38, did not have any execution units that receive as an input an electrical signal representing numbers having a dynamic range at least as wide as from 1/1,000,000 through 1,000,000, and that transmit as an output for at least X = 5% of the possible valid inputs to that operation, an electrical signal representing numbers that differ by at least 0.05% from the result of an exact mathematical calculation of that operation on the numerical values of that

> same input. The graphics processors disclosed in the '156 patent at 5:36-38 did not include a single LPHDR execution unit according to claim 7. Dr. Bates was the first to reduce to practice a computer that includes an LPHDR execution unit, and even coined "LPHDR" to describe the unit. As computers that included LPHDR execution units did not exist in the prior art, their use in the invention was not the use of existing computing technology or an existing implementation of computer processor.

See also id. at ¶¶ 57-58, 72-73; '156 patent at 2:14-17:29, Figs. 1-6; '961 patent at 1:66-17:39.

Given the foregoing record and the early stage of these proceedings, the asserted claims are deemed directed to an unconventional improvement in computer technology and, thus, are patent eligible. *Aatrix*, 882 F.3d at 1129-30 ("We have repeatedly held that inventions which are directed to improvements in the functioning and operation of the computer are patent eligible").

D. GOOGLE'S OTHER *ALICE* ARGUMENTS

1. Throughout its brief, Google attempts to trivialize the inventions claimed in the patents-in-suit. According to Google, the claimed inventions are directed to nothing more than the known practice of "calculating a 20% tip on a dinner check"! Mot. at 12. Google's grossly oversimplified argument is not only legally flawed, but is also contradicted by its own actions. Despite the known practice of tipping 20% that Google now touts, Google's inability to service its AI computing demands not only existed, but (according to its top computer architects) had created a situation that was "scary and daunting." *See* AC at ¶ 15. Did Google solve this problem by implementing a simple restaurant tipping feature? No.

Instead, Google sought out Dr. Bates and, under an NDA, gained knowledge of Dr. Bates' LPHDR-based computer architecture. Thereafter, Google incorporated Dr. Bates' patented LPHDR architecture into all its TPUv2 and TPUv3 computers. AC at ¶¶ 17-25. As set forth *supra*, the asserted claims are directed to an unconventional improvement in computer hardware, not tipping in a restaurant. As "the claimed solution is necessarily rooted in computer technology in order to overcome a problem specifically arising in the realms of computer

networks," the claims are directed to inventive concepts. *See, e.g.*, *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1257 (Fed. Cir. 2014).

2. Google attempts to support its argument that the claimed LPHDR execution units are conventional by reference to column 5:11-30 of the '273 patent specification. *See, e.g.*, Mot at 12-13, 17. When not cropped, and instead read in its entirety, however, column 5 states just the opposite. The prior art at column 5 discloses a GPU that supports three (16-bit, 32-bit and 64-bit) floating-point formats. *See* '273 patent at 5:31-33. Google argues that this part of the specification "refers to then-existing, conventional computing implementations that used low-precision high dynamic range number formats in conventional computing implementations." Mot. at 5; *see also id.* at 17. This assertion is manifestly incorrect. None of these implementations had execution units that operated upon high dynamic range input at low precision as recited in the asserted claims. *See* '273 patent at 5:31-40; AC at ¶ 42. In the prior art:

> (1) a high dynamic range input is always inefficiently processed in the disclosed GPU by a high precision execution unit, which is opposite to the claimed invention, and
>
> (2) there is no execution unit (circuit) in the disclosed GPU that performs high dynamic range operations with low precision.

See '273 patent at 5:31-40; *see also* AC at ¶ 42.

As explained in the following part of column 5 ignored by Google, however, the particular prior art Google relies upon represents the problem not the solution:

> When a graphics processor includes support for 16 bit floating point, that support is alongside support for 32 bit floating point, and increasingly, 64 bit floating point. That is, the 16 bit floating point format is supported for those applications that want it, but the higher precision formats also are supported because they are believed to be needed for traditional graphics applications and also for so called "general purpose" GPU applications. Thus, existing GPUs devote substantial resources to 32 (and increasingly 64) bit arithmetic and are wasteful of transistors in the sense discussed above.

See '273 patent at 5:31-40.

Prior to Dr. Bates, there were no LPHDR computers with execution units (circuits), let alone a hundred or more of such circuits on a single chip generating materially inaccurate results. *See* AC at ¶¶ 33, 42-43, 49, 66, 74. In fact, Dr. Bates himself coined the name LPHDR. *Id*. at 42. Moreover, the Patent Examiner granted the claims over the prior art now relied upon by Google. In short, the claims are presumed valid, and Google has a heavy burden to prove its 101 defense by clear and convincing evidence. *Cellspin*, 927 F.3d at 1319; *see also Kenexa*, 2015 WL 1943826, at *7. Google's "conventional" argument is disputed by Singular in the AC at ¶¶ 42, 59, 83-84, 100-01, 118-19 and is inconsistent with the patent specification. *See* '273 patent at 5:31-40. Accordingly, Google's argument should be rejected at this pleadings stage of the case. *Cellspin*, 927 F.3d at 1317 (court should "accept[] the[patent owner's] allegations as true.")

3. Google also argues under Step 2 that computers using floating-point arithmetic and logarithmic number formats were well known prior to Dr. Bates' inventions. *See* Mot. at 3-4, 7, 10-11. Such a gross oversimplification of the claims should be rejected. *See, e.g., Diehr*, 450 U.S. at 189 n. 12; *see also McRO, Inc. v. Bandai Namco Games Am., Inc.*, 837 F.3d 1299, 1313 (Fed. Cir.2016) ("[w]e have previously cautioned that courts 'must be careful to avoid oversimplifying the claims' by looking at them generally and failing to account for the specific requirements of the claims") (citations omitted). As the detailed limitations of the claims demonstrate, Dr. Bates does not claim to have invented floating-point arithmetic or logarithmic number formats. Rather, the asserted claims are directed to specific, unconventional improvements in computers that were significant enough for Google to retrofit all of its data centers throughout the United States with the infringing LPHDR TPUv2 and TPUv3 computers.

4. Google argues that the asserted claims are abstract under the "fundamental and still-operative principles" set forth in *Gottschalk* and *Flook*. Mot. at 9-14. Unlike in *Gottschalk*

and *Flook*, however, claims 53, 7 and 4 are all directed to a computer (device) not a computer program. Addressing *Gottschalk* and *Flook* directly, the Supreme Court subsequently made clear that claims including a mathematical process are patent eligible:

> Our earlier opinions lend support to our present conclusion that a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer. In *Gottschalk v. Benson*, we noted, "it is said that the decision precludes a patent for any program servicing a computer. We do not so hold." 409 U.S. at 71, 93 S. Ct. at 257. Similarly, in *Parker v, Flook*, we stated that "a process is not unpatentable simply because it contains a law of nature or mathematical algorithm." 437 U.S. at 590, 98 S. Ct. at 2526. It is now commonplace that an application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection. (citations omitted).

Diehr, 450 U.S. at 188. Thus, Google's attempt to argue that the claims are directed solely to patent ineligible arithmetic or mathematical formulae should be rejected.

5. Google argues that the asserted claims lack an inventive concept because the claimed parameters of imprecision are "arbitrary." Mot. at 19-20. Google's argument is directly contradicted by the specifications of the patents-in-suit. For example, the '273 patent lists many experiments conducted by Dr. Bates, from which he was able to determine what he believed were suitable parameters for combining dynamic range and acceptable imprecision. *See* '273 patent at 19:21-20:60. Such detailed experimentation is the antithesis of arbitrariness.

6. Finally, Google asserts that "the patents in suit attempt to monopolize a simple, abstract idea: when doing math, sometimes the exactly right calculation is unnecessary because close enough suffices." *See, e.g.*, Mot. at 1. This argument is meritless. The Federal Circuit has repeatedly warned against such attempts to oversimplify the claims for the purposes of urging patent ineligibility under Section 101. *See Enfish*, 822 F.3d at 1337 ("describing the claims in such a high level of abstraction and untethered from the language of the claims all but ensures that the exceptions to § 101 swallow the rule."); *see also McRO v. Bandai*, 837 F.3d at 1313 (citations omitted). Claims 53, 7 and 4 do not attempt to monopolize mathematics, logarithms or

multiplication. As recognized by Google (Mot. at 7), asserted claims 53, 7 and 4 are apparatus claims that define a computer with numerous precisely-defined elements, any one of which, if removed from an accused products, may avoid infringement.

E. GOOGLE'S CASELAW IS INAPPOSITE

The cases relied upon by Google are inapposite. First, *Silicon Graphics* (Mot. at 1) was not a 101 case and, in any event, cuts against Google's argument. The patent at issue there related to "a graphics system and process that predominantly operates on a floating-point format." *Silicon Graphics, Inc. v. ATI Techs., Inc.*, 607 F.3d 784, 786 (Fed. Cir. 2010). Defendant ATI argued that the claims were anticipated by prior art floating-point computers. *Id.* at 795-98. Eligibility under § 101 was not an issue in that appeal. Moreover, the Federal Circuit upheld the jury's verdict that ATI failed to prove anticipation. *Id.* at 798. Thus, as here, the claims in *Silicon Graphics* provided patentable improvements over the prior computers.

Google's reliance on the non-controlling opinion in *Uniloc v. Rackspace* (Mot. at 3) fares no better. For a start, the claim at issue in that case was a method claim. *See Uniloc USA, Inc. v. Rackspace Hosting, Inc.*, 18 F. Supp. 3d 831, 834 (E.D. Tex. 2013).[5] Unlike in *Uniloc*, the asserted claims here are all apparatus claims directed to a then-unknown and unconventional specific computer (LPHDR) architecture that improved computer performance thirty-fold. *See* AC at ¶ 14. Moreover, the Federal Circuit's opinion in *Enfish* issued after Judge Davis' opinion in *Uniloc*.

As the Federal Circuit stated in *Enfish*, if the focus is on "an improvement to computer functionality," the claim is patent eligible, not abstract. *Id.* at 1336. As alleged in the AC, the

[5] Judge Davis found that the claim failed the machine part of the machine-or-transformation test because "the '697 patent does not recite a machine." *Id.* at 835. All asserted claims in this case recite apparatus elements.

asserted claims are directed to LPHDR computers that provide an improvement in computer functionality. *See, e.g.,* AC at ¶¶ 9-13. These allegations must be taken as true. *Ruiz*, 496 F.3d at 5. Such improvements in computing are patent eligible. *See, e.g.*, *Koninklijke KPN*, 942 F.3d at 1151 (claims that "improve[] the functioning of the overall technological process of detecting systematic errors in data transmissions" are patent eligible); *Aatrix*, 882 F.3d at 1128 ("[t]here are concrete allegations regarding the claimed combination's improvement to the functioning of the computer"); *see also Berkheimer v. HP*, 881 F.3d at 1369; *BASCOM v. AT&T*, 827 F.3d at 1350-51.

V. CONCLUSION

For the reasons set forth above, Google's motion to dismiss should be denied.

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Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that all counsel of record who have consented to electronic service are being served with a copy of this document via the Court's CM/ECF system.

/s/ Kevin Gannon